

Marshall & Moore Apartments

STORMWATER CALCULATIONS

BY

LARSON ENGINEERING

Revised January 29, 2018

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(100-yr event)**

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision, and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.



Eric G. Meyer, P.E.

1.29.17

Date

44592

Registration No.

Marshall & Moore Apartments

SUMMARY OF STORMWATER RUNOFF

Introduction:

This project will consist of the construction of a multi-story apartment building with an underground parking structure. The portion of the parking structure beyond the housing footprint will contain a green roof system.

The runoff from the green roof and the tradition roof will be directed to an underground storage pipe on the south side of the building to control the runoff rate. The pipe is restricted by a weir wall within the last manhole before the runoff enters the Marshall Avenue storm sewer system.

Site Area:

Building, Drives and Walks	= 8,529 sf
Green Area	= 5,295 sf
<i>Total</i>	<i>= 14,170 sf</i>

Rate Control Requirement:

14,171 sf / 43,560 x 1.64 cfs = **0.53 cfs**

Proposed Conditions:

100-year, 24-hour Runoff (node 7R) = **0.51 cfs**

100-year Peak Elevation is Stormwater system = **889.92'**

Trench Capacity

Instructions:

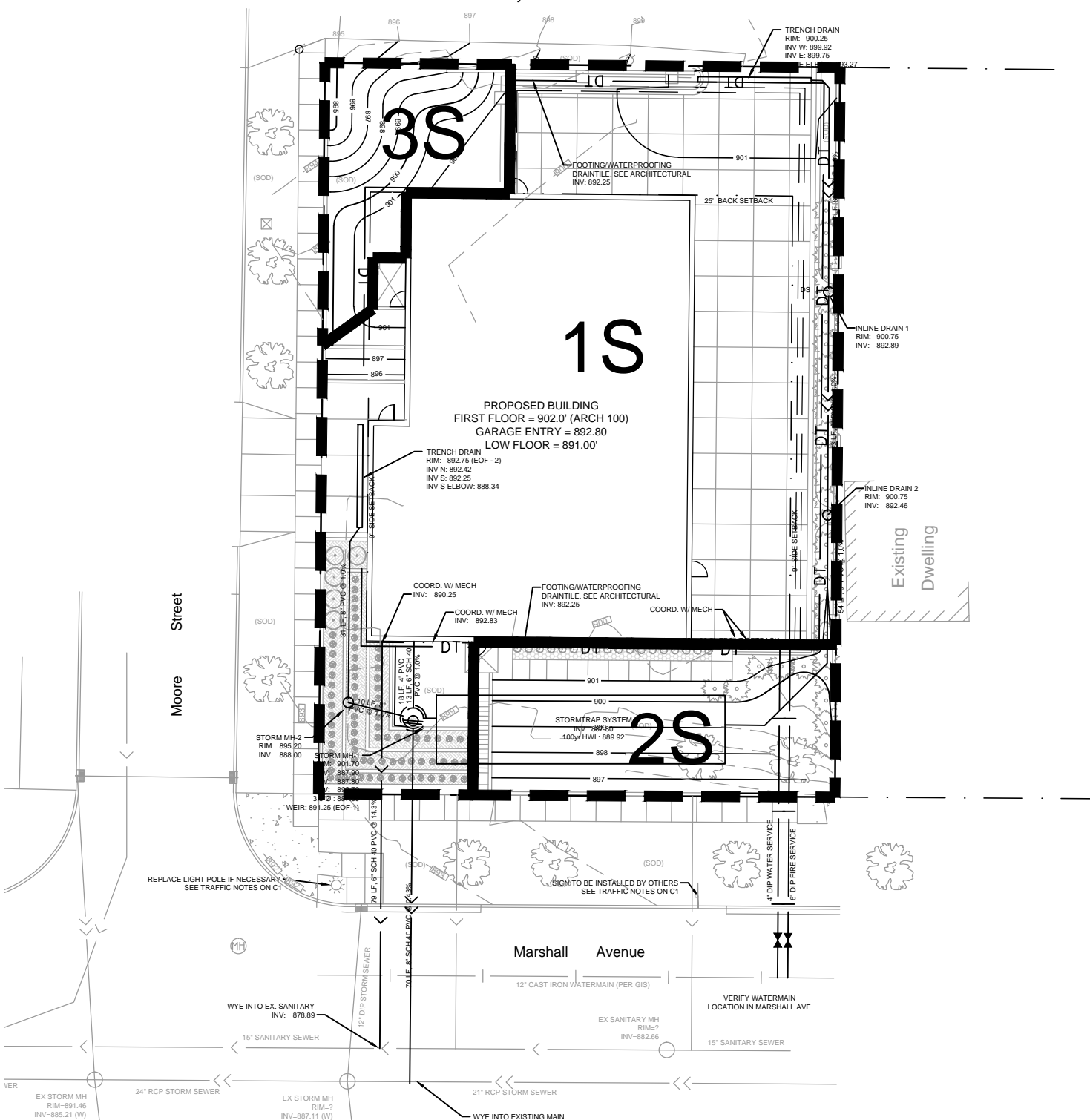
1. Select a catalog number (will automatically fill in Open Area and Perimeter) or enter your own values
2. Enter head value
3. Click "calculate"

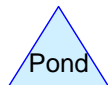
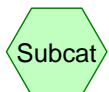
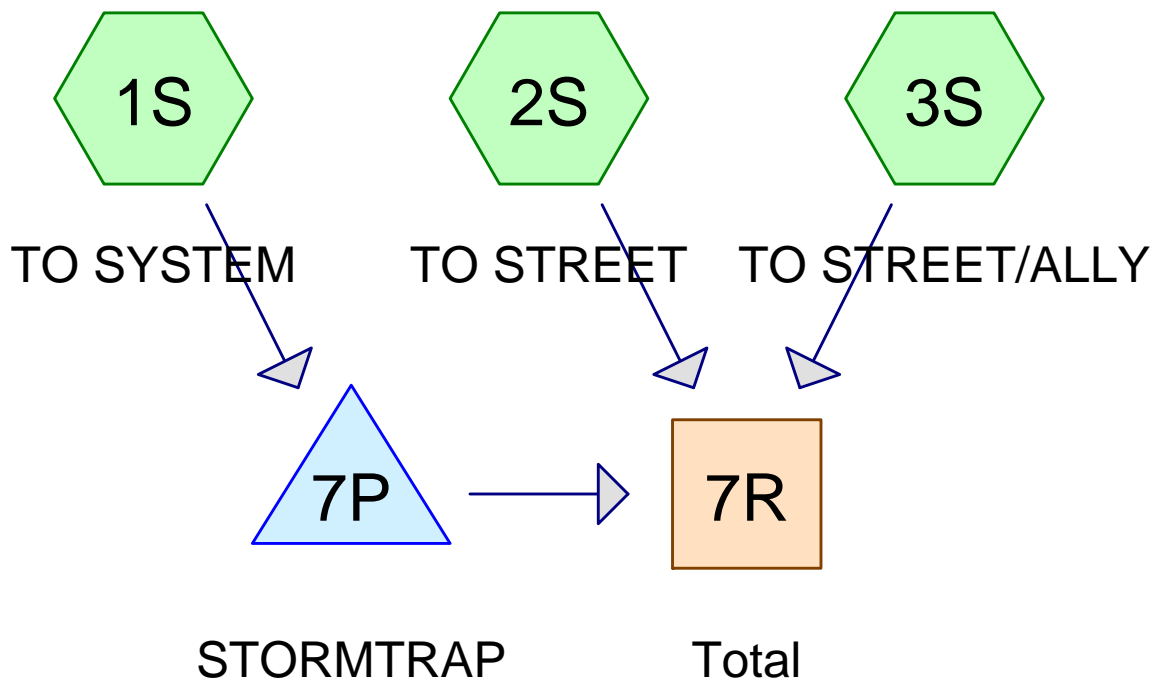
The results will determine automatically if your situation falls into a Weir, Transitional or Orifice flow. Additionally, Neenah grates which fall within the parameters chosen will appear below the calculator.

Catalog Number and Grate Type: <div>R-4990-AX: A</div>		
Lineal feet of trench: <div>22</div>	Flow direction: <input checked="" type="radio"/> Both Directions <input type="radio"/> One Direction	
Feet perimeter (P): <div>2</div>	Head in feet (h): <div>0.1</div>	Free open area in sq. ft. (A): <div>0.2</div>
<div>Calculate</div>		
Weir capacity in cfs: <div>4.6</div>	Transitional flow in cfs: <div></div>	Orifice capacity in cfs: <div></div>

The Capacity of 22 feet of trench at a low point with water flowing to it from both long sides is 4.6 cfs. Warning: be sure your trench has the ability to transport this flow.

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Area Listing (all nodes)

Area (sq-ft)	CN	Description (subcatchment-numbers)
5,295	61	>75% Grass cover, Good, HSG B (1S, 2S, 3S)
8,529	98	Buildings and Parking (1S)
346	98	Unconnected pavement, HSG B (2S)
14,170	84	TOTAL AREA

Marshall Avenue Apartments

Type II 24-hr 100 year Event Rainfall=5.90"

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Summary for Subcatchment 1S: TO SYSTEM

Runoff = 1.45 cfs @ 12.06 hrs, Volume= 4,282 cf, Depth> 4.73"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Event Rainfall=5.90"

Area (sf)	CN	Description
* 8,529	98	Buildings and Parking
2,326	61	>75% Grass cover, Good, HSG B
10,855	90	Weighted Average
2,326		21.43% Pervious Area
8,529		78.57% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.0					Direct Entry,

Summary for Subcatchment 2S: TO STREET

Runoff = 0.19 cfs @ 11.98 hrs, Volume= 379 cf, Depth> 2.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Event Rainfall=5.90"

Area (sf)	CN	Adj	Description
346	98		Unconnected pavement, HSG B
1,733	61		>75% Grass cover, Good, HSG B
2,079	67	64	Weighted Average, UI Adjusted
1,733			83.36% Pervious Area
346			16.64% Impervious Area
346			100.00% Unconnected

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.9	30	0.0600	0.09		Sheet Flow, Grass: Bermuda n= 0.410 P2= 2.70"

Summary for Subcatchment 3S: TO STREET/ALLY

Runoff = 0.12 cfs @ 11.90 hrs, Volume= 200 cf, Depth> 1.94"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
Type II 24-hr 100 year Event Rainfall=5.90"

Area (sf)	CN	Description
1,236	61	>75% Grass cover, Good, HSG B
1,236		100.00% Pervious Area

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Type II 24-hr 100 year Event Rainfall=5.90"

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Summary for Reach 7R: Total

Inflow Area = 14,170 sf, 62.63% Impervious, Inflow Depth > 4.07" for 100 year Event event
 Inflow = 0.51 cfs @ 11.97 hrs, Volume= 4,807 cf
 Outflow = 0.51 cfs @ 11.97 hrs, Volume= 4,807 cf, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Summary for Pond 7P: STORMTRAP

Inflow Area = 10,855 sf, 78.57% Impervious, Inflow Depth > 4.73" for 100 year Event event
 Inflow = 1.45 cfs @ 12.06 hrs, Volume= 4,282 cf
 Outflow = 0.45 cfs @ 12.31 hrs, Volume= 4,228 cf, Atten= 69%, Lag= 14.7 min
 Primary = 0.45 cfs @ 12.31 hrs, Volume= 4,228 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Peak Elev= 889.92' @ 12.31 hrs Surf.Area= 792 sf Storage= 1,343 cf

Plug-Flow detention time= 39.8 min calculated for 4,226 cf (99% of inflow)

Center-of-Mass det. time= 31.8 min (820.1 - 788.3)

Volume	Invert	Avail.Storage	Storage Description
#1	887.80'	1,901 cf	13.31'W x 59.50'L x 3.00'H Prismatic 2,376 cf Overall x 80.0% Voids

Device	Routing	Invert	Outlet Devices
#1	Primary	887.80'	12.0" Round Culvert L= 69.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 887.80' / 887.50' S= 0.0043 '/' Cc= 0.900 n= 0.010 Concrete pipe, straight & clean, Flow Area= 0.79 sf
#2	Device 1	887.80'	3.5" Vert. Orifice/Grate C= 0.600
#3	Device 1	890.00'	2.0' long Sharp-Crested Rectangular Weir 2 End Contraction(s)

Primary OutFlow Max=0.45 cfs @ 12.31 hrs HW=889.92' TW=0.00' (Dynamic Tailwater)

- 1=Culvert (Passes 0.45 cfs of 4.50 cfs potential flow)
 2=Orifice/Grate (Orifice Controls 0.45 cfs @ 6.77 fps)
 3=Sharp-Crested Rectangular Weir (Controls 0.00 cfs)